

A photograph of an astronaut inside a space station, looking out of a large window at the Earth from space. The astronaut is in profile, resting their chin on their hand. The Earth's horizon is visible through the window, showing a blue sky and white clouds. The interior of the space station is dark, with some equipment visible.

Sustainability at NASA

Nick Murdock
Agency Sustainability Program Manager



My Journey

Career

- US Air Force (Civilian)
 - 2008 – 2011, Water Program Manager
 - 2011 – 2012, Project Programmer
 - 2012 – 2013, Downrange Engineer
- NASA
 - 2013 – 2016, Project/Design/Construction Manager
 - 2016 – 2019, Energy and Water Conservation Manager
 - 2019 – Present, Environmental Management Branch Chief
 - 2023 – Present, Agency Sustainability Program Manager

Education/Certifications

- 2008, BS Civil/Environmental Engineering, Ohio State University
- 2012, LEED AP BD+C
- 2013, State of FL Professional Engineer
- 2020, MS Engineering Management, University of Central Florida

The image features the NASA logo in white, bold, sans-serif capital letters. Below the logo is the slogan "WE DREAM BIG, WE WORK TOGETHER" in a smaller, white, sans-serif font. The background is a photograph of a rocket launch at dusk or dawn, with a large crowd of people in the foreground watching the event. The rocket is on the left side of the frame, ascending into a sky with soft orange and blue hues.

NASA

WE DREAM BIG,
WE WORK TOGETHER

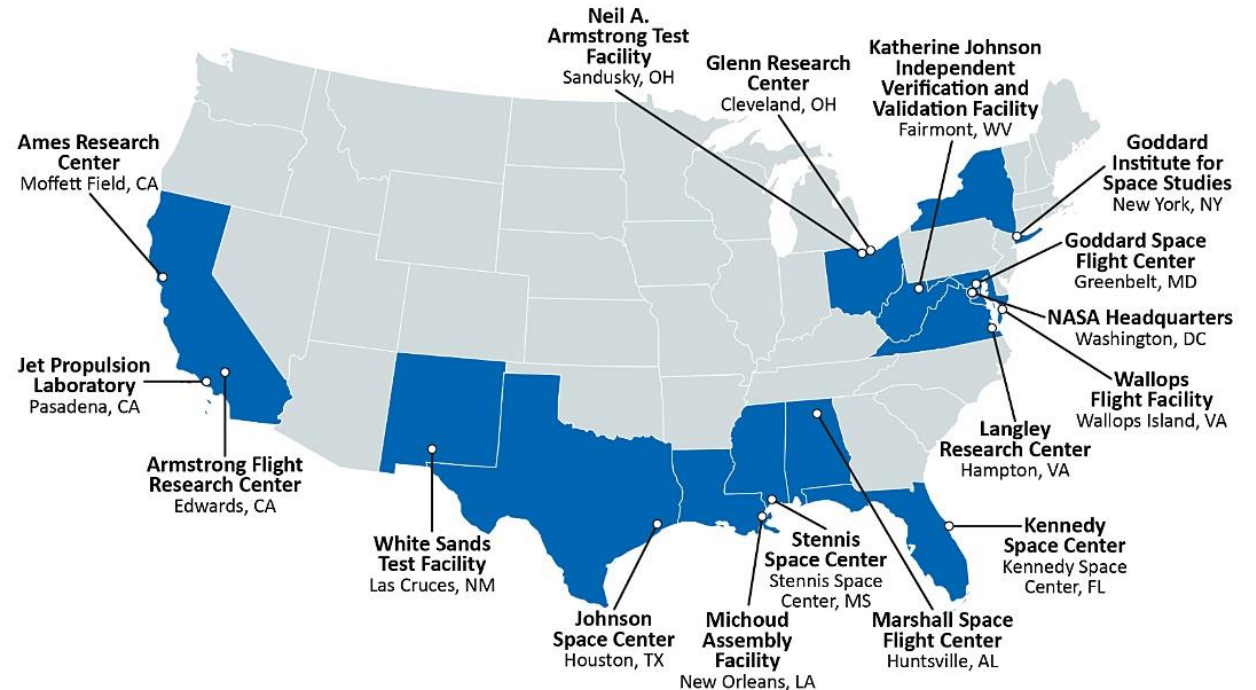
Our Vision, Mission and Values


- **Vision:** Exploring the secrets of the universe for the benefit of all.
- **Mission:** NASA explores the unknown in air and space, innovates for the benefit of humanity, and inspires the world through discovery.



Organization Structure and Locations

- Office of the Administrator
- Administrator Staff Offices
- Mission Directorates
 - Aeronautics Research
 - Exploration Systems Development
 - Science
 - Space Operations
 - Space Technology
- Mission Support Directorate
 - Agency's Chief Sustainability Officer (CSO)
 - Environmental Management Division





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Aeronautics Research

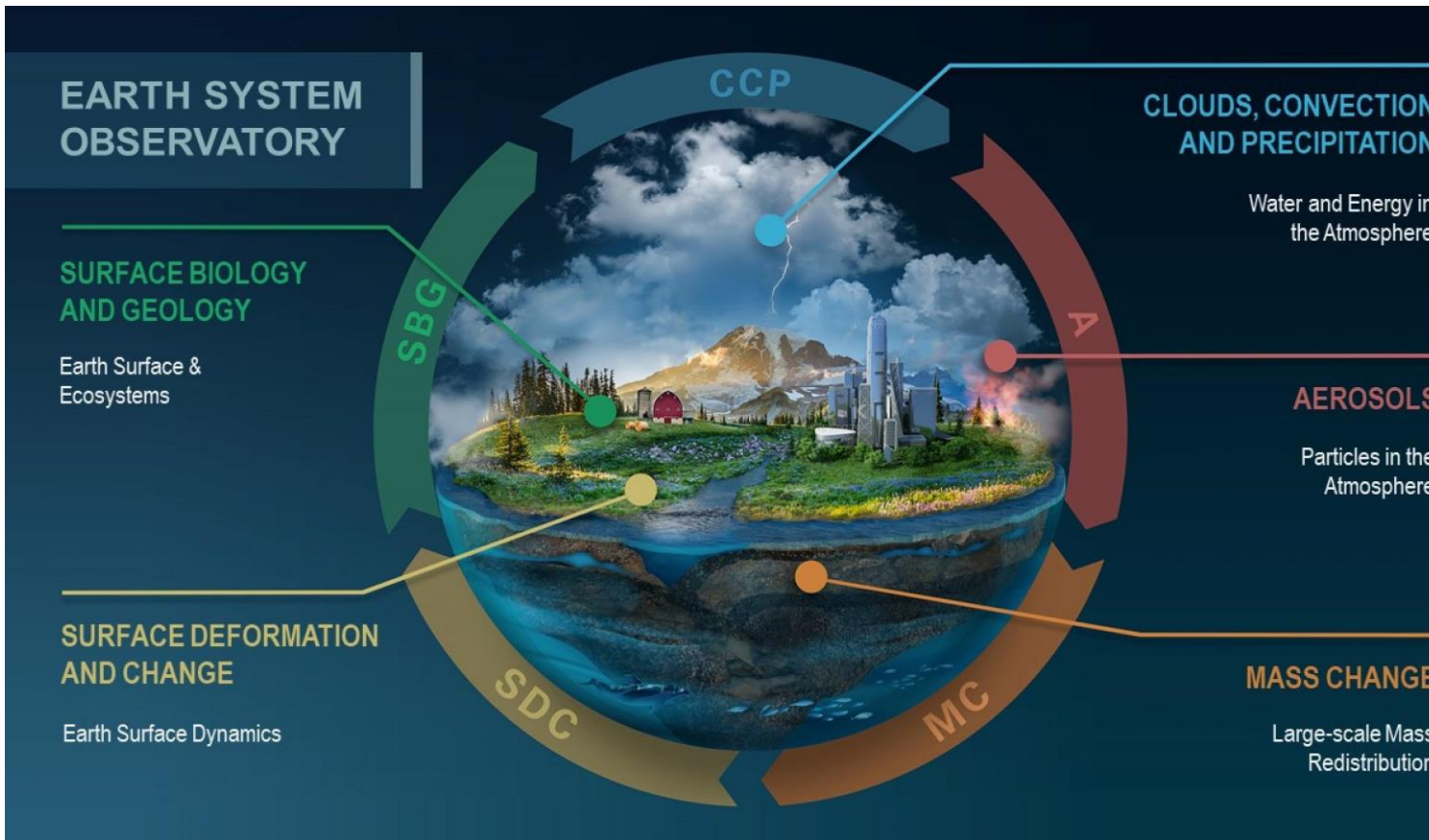
- “...meet future needs of the aviation community, the nation, and the world for safe, efficient, flexible, and environmentally sustainable air transportation.”

Artist concept of commercial aircraft families with a Transonic Truss-Braced Wing configuration from the Sustainable Flight Demonstrator project.
Credits: Boeing



Exploration Systems Development

- “...manages systems development for programs critical to the NASA’s Artemis program and planning for NASA’s Moon to Mars exploration approach in an integrated manner.”



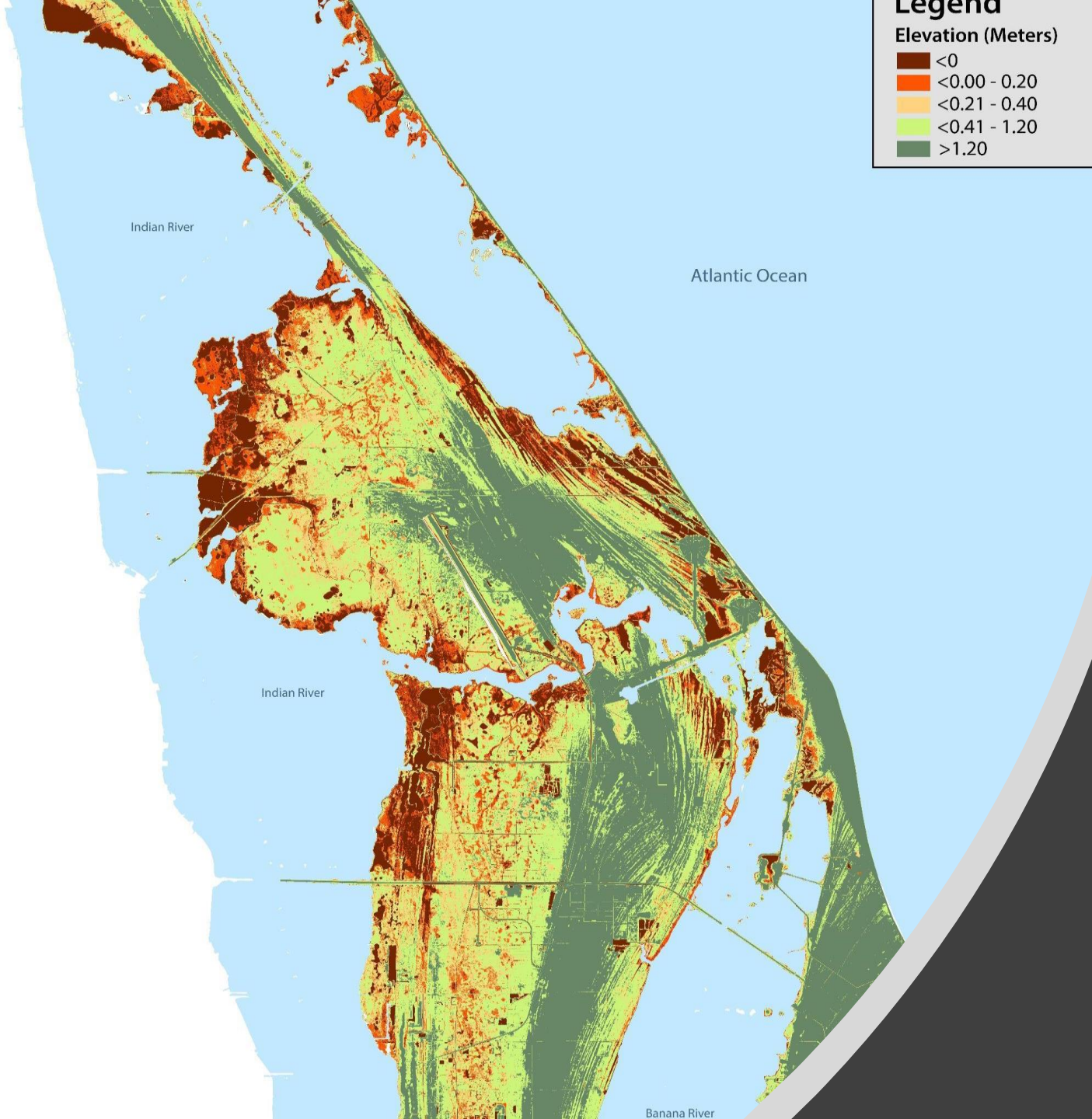
- “...organization where discoveries in one scientific discipline have a direct route to other areas of study.”
- Better inform decision-makers on how our planet is changing.

Science

Space Operations & Space Technology

- “...responsible for enabling sustained human exploration missions and operations in our solar system.”
- “...transform future missions while ensuring American leadership in aerospace.”





Mission Support

“...providing foundational support capabilities responsive to evolving mission needs.”

What is Sustainability?

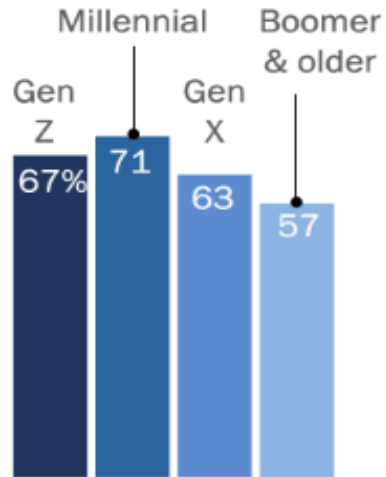
- Sustainability at NASA is the responsible usage, protection and conservation of finite and precious resources, to include natural, cultural, energy and water and others.
- As a result, we ensure mission continuance, affordability and success by preparing for a changing climate and minimizing our impacts so that future generations can meet their needs.



Why does Sustainability Matter?

% of U.S. adults who say ...

Climate should be top priority to ensure sustainable planet for future generations



Pew Research

- Sustainability is a matter of mission continuance, affordability and success (can't ignore it)
- Our workforce and the public expect it (need to remain relevant)
- The White House and Congress have placed an emphasis on it (must do it)



"Sustainability is now both a strategic and operational necessity."

- Dr. Joel Carney

Assistant Administrator, OSI
& NASA's Chief Sustainability Officer

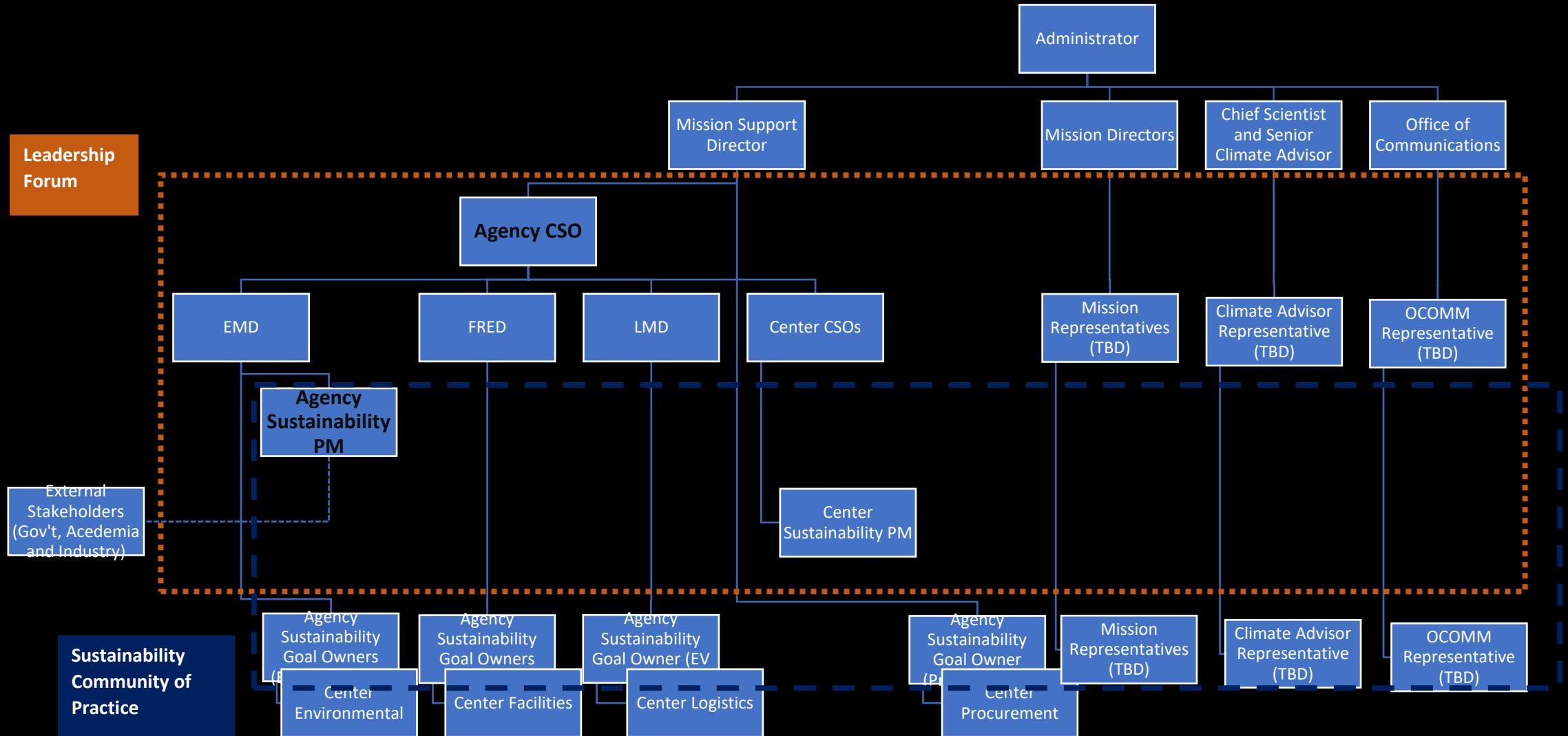


Prioritizing sustainable choices and environmental action by employers

Protecting the environment remains a top priority for Gen Zs and millennials. About three-quarters of respondents believe the world is at a tipping point in responding to climate change, but less than half are optimistic that efforts to protect the planet will be successful.

Deloitte

Sustainability Team Structure



Current Goals



100% Carbon
Pollution-Free
Electricity by
2030, including
50% on a 24/7
basis



100% Zero-
Emission Vehicle
Acquisitions by
2035, including
100% light-duty
acquisitions by
2027



Net-Zero
Emissions
Buildings by
2045, including a
50% reduction by
2032



Net-Zero
Emissions
Procurement by
2050



Net-Zero
Emissions
Operations by
2050, including a
65% reduction by
2030



Climate Resilient
Infrastructure
and Operations



Develop a
Climate- and
Sustainability-
Focused
Workforce



Advance
Environmental
Justice and
Equity-Focused
Operations



Accelerate
Progress through
Domestic and
International
Partnerships

Net-zero emissions operations by 2050 and Net-zero emissions buildings by 2045

- Design new construction and major renovations to be net-zero emissions capable (except when impractical or infeasible due to facility operational requirements such as a wind tunnel).
- Increase use of low embodied carbon building materials. NASA has identified an upcoming infrastructure project, Replacement of the Wallops Island Causeway Bridge, that will use the ENVISION certification system for infrastructure projects as a guide for ensuring project resilience and sensitivity to the fragile environment where construction will occur.
- Continue an aggressive demolition program through the identification and removal of inefficient low-mission facilities, reducing carbon emissions and waste.
- Improve building efficiencies and operations of mission-required facilities by continuing condition-based maintenance strategies and increasing training to facility managers.
- Per 50001 Ready, establish annual site-specific, data-driven water reduction goals, with a focus on significant water uses, to be tracked beginning FY 2023.
- Continue implementing energy conservation projects with Construction and Environmental Compliance and Restoration (CECR) appropriations and EUL net revenue (revenue beyond expenses of hosting lease agreement tenants), and through energy performance contracts.
- Institutionalize Department of Energy (DOE) 50001 Ready across all NASA sites, including setting annual site-specific, data-driven energy reduction goals, with a focus on significant energy uses, to be tracked beginning FY 2023.
- Continue to improve water efficiency through water infrastructure and metering projects with CECR appropriations and through energy performance contracts.
- Conduct water leak detection and water balance studies.
- Install advanced water treatment systems on major cooling towers to reduce water losses.

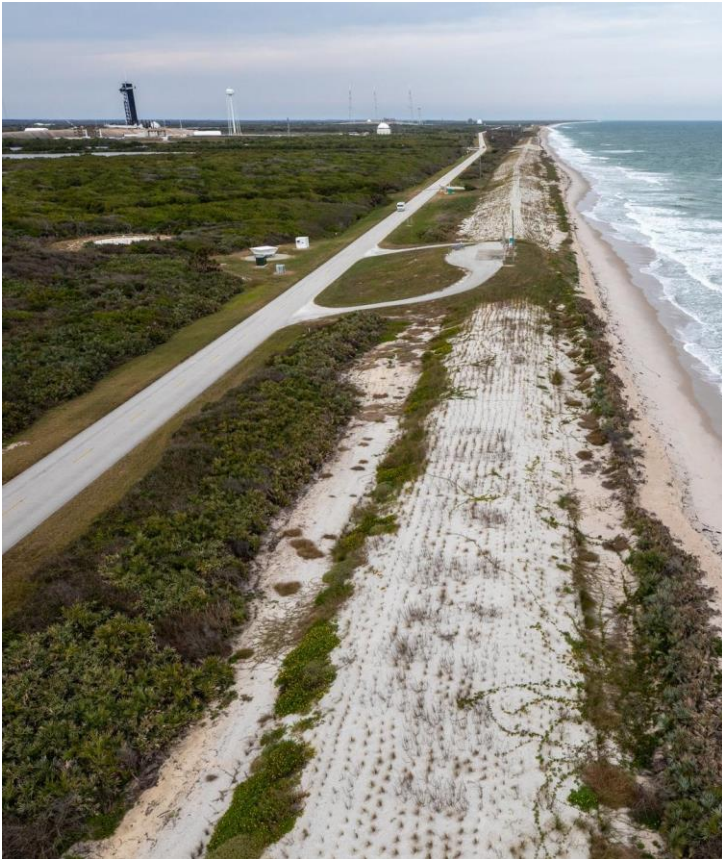


100% 24/7 carbon pollution-free electricity by 2035

- Continue building on-site CFE generation/storage and/or purchasing CFE where feasible, using appropriated funds and energy performance contracts.
- Continue participation in the Federal Energy Management Program Energy Storage Initiative to identify and procure resilient CFE projects (two site assessments “in progress”).
- Continue assessing opportunities to partner with utility providers through enhanced use lease (EUL) agreements to develop on-site CFE generation on underutilized real property. As of FY 2022, NASA is hosting a total of 104.5 megawatts (MW) of photovoltaic (PV) systems at Kennedy Space Center (KSC) (two systems totaling 84.5 MW) and one system of 20 MW at Michoud Assembly Facility, which feed directly into the utility providers’ grids.



Climate resilient infrastructure and operations



- Identify and implement adaptation strategies to avert potential mission impacts from climate change.
- Integrate climate adaptation planning and actions into the Agency Master Plans as well as Agency programs, policies, and operations.
- Minimize impacts to climate from Agency programs, policies, and operations.
- Execute priority climate scientific research, including climate observations, analysis, and modeling.
- Lead efforts and collaborate on climate change issues, sharing knowledge with a wide range of stakeholders.

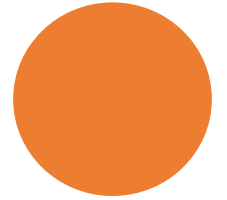
Net-zero emissions procurement by 2050

- Use NASA's Recycling and Sustainable Acquisition community of practice to reduce waste generation, prioritize reuse, and improve waste diversion through policy, outreach, measurement/verification, and collaboration on best practices.
- Use functional reviews to improve NASA Center Environmental Management Systems, Energy Management Systems, and pollution prevention, sustainability, and sustainable procurement programs.
- Revise NASA procurement processes to support compliance with Federal Acquisition Regulation clause prescriptions and FPDS reporting requirements.
- Review training and identify changes to align with current requirements.



All fleet acquisitions ZEV by 2035

- Continue annual utilization reviews to identify the smallest-sized vehicle to best meet mission requirements and to reduce the need for vehicle assets from inventory.
- Establish agreements with utility providers to install EVSE (28 are “in progress” in FY 2022, owned and maintained by a utility for 10 years before transition to NASA property).
- Fund EVSE infrastructure (two EVSEs installed and 80 more EVSEs will be “in progress” by the end of FY 2022).





Develop a Climate- and Sustainability-Focused Workforce

- Establish an internal collaboration site for sustainability and climate leadership, goals, and progress across the Agency.
- Internally advertise the “Sustainability Speaker Series for the Federal Community.”
- Continue internal climate and sustainability education and training.
- Participate in the Federal Climate Action Plan community network.

Advance Environmental Justice and Equity-Focused Operations

- Track progress in key areas, which are impactful steps toward improving diversity, equity, inclusion, and accessibility both internally and externally to NASA:
 1. leverage Earth science and socioeconomic data to help mitigate environmental challenges in underserved communities, and
 2. expand access to climate data to limited English proficient populations within underserved communities.
- Improve the accessibility and awareness of climate and environmental data and information NASA collects and generates, including updating public-facing websites, improving accessibility to grants, and building relationships with diverse community partners.



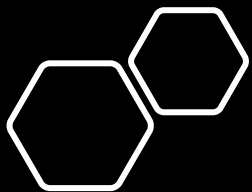
**National Aeronautics and Space Administration
FY 2021 OMB SCORECARD FOR FEDERAL SUSTAINABILITY**

GOAL ASSESSMENT		METRICS	PERFORMANCE RATING*	OTHER PROGRESS INDICATORS				
				Scope	Sector (MTCO2e)	FY 2008	FY 2020	FY 2021
GREENHOUSE GAS EMISSIONS FROM STANDARD OPERATIONS	Change in scope 1&2 emissions from FY 2008:	-45.7%		1 & 2	Total	1,255,260	697,803	681,975
	Change in scope 1&2 emissions from prior year:	-2.3%						
	Change in scope 1 facility energy emissions from FY 2008:	-5.2%		1	Facility	164,612	153,788	156,060
	Change in scope 2 facility energy emissions from FY 2008:	-55.5%		2	Facility	958,712	448,267	426,322
	Change in scope 1 fleet energy emissions from FY 2008:	-72.1%		1	Fleet	12,000	3,796	3,347
	Change in scope 1 other emissions from FY 2008:	-19.8%		1	Other	119,936	91,952	96,247
				1	Direct GHG intensity of all facilities (kg/GSF):			4.07
FACILITY ENERGY EFFICIENCY	Change in energy intensity (Btu/GSF) compared to FY 2003:	-41.1%		Category		FY 2003	FY 2020	FY 2021
				Energy intensity (Btu/GSF):		215,906	122,206	127,128
	Change in energy intensity (Btu/GSF) from prior year:	4.0%		Energy use (Net billion Btu):		6,850	3,839	3,973
				Gross Square Feet (thousand):		31,729	31,411	31,254
EFFICIENCY MEASURES/ INVESTMENT	Covered facilities evaluated for efficiency opportunities (in terms of covered facility energy use):	57.4%		Implementation cost of ECMs identified within last 4 years (\$M):				\$135.9
				CTS-reported investment in covered facilities in FY 2021 (\$M):				na
	Performance contracting investment percentage in FY 2021	78.4%		Total direct investment in FY 2021 (\$M):				\$7.7
	Performance contracting investment percentage last 4 years	57.3%		ESPC and UESC investment in FY 2021 (\$M):				\$27.8
RENEWABLE ENERGY USE	Renewable electricity used (as a percentage of total electricity use):	9.6%		Renewable electricity + non-electric renewable energy used (as a percentage of total electricity use):				23.9%
WATER EFFICIENCY	Change in potable water intensity compared to FY 2007:	-35.2%		Category		FY 2007	FY 2020	FY 2021
	Change in potable water intensity from prior year:	-4.7%		Facility Water Intensity (Gal per GSF)		73.2	49.7	47.4
HIGH PERFORMANCE SUSTAINABLE BUILDINGS	Percent of eligible buildings meeting sustainability criteria:	21.9%		Buildings meeting sustainability criteria:				48
	Percentage point difference from prior year:	1.7		Total count of eligible buildings:				219
	Percent of GSF (eligible) meeting sustainability criteria:	26.4%		GSF meeting sustainability criteria (thousand):				3,418
	Percentage point difference from prior year:	1.4		Total eligible GSF (thousand):				12,923
TRANSPORTATION/ FLEET MANAGEMENT	Change in petroleum fuel use in covered fleet compared to FY 2005:	-71.3%		Alternative fuel use as a percentage of total covered fleet fuel use:				14.8%
				Covered AFVs (w/bonus credits) as a percent of acquisitions:				153.0%
	Change in petroleum fuel use in covered fleet compared to prior year:	-11.9%		Light-duty zero-emission vehicles as a percent of acquisitions:				9.64%
				Total number of installed EV charging ports to date:				359
SUSTAINABLE ACQUISITION	Percentage point difference of sustainable contract actions from prior year:	0.2		Number of applicable contract actions w/ sustainable clauses, FY21:				4,947
				Number of applicable contract actions w/ sustainable clauses, FY20:				4,828
	Percentage point difference of value of contracts with sustainable requirements from prior year:	1.8		Value of applicable contract actions w/ sustainable clauses, FY21:				\$3,464.3M
				Value of applicable contract actions w/ sustainable clauses, FY20:				\$3,125.8M

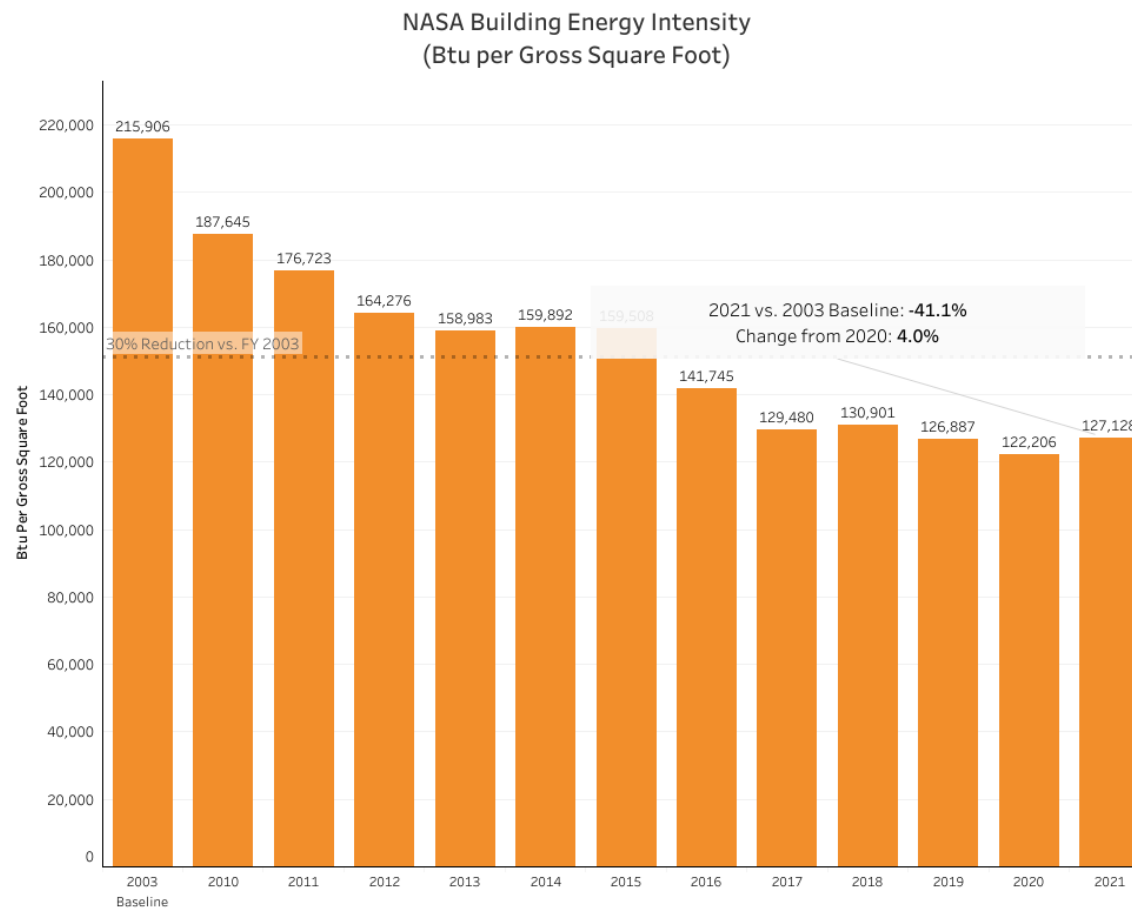
*Due to the COVID-19 pandemic, the data as reported may appear anomalous and represent exogenous factors beyond the agency's control. The impact on agency performance has not been fully evaluated at this time.

Sources: Agency submitted data from Annual Energy Data Report, EISA 432 Compliance Tracking System, Federal Real Property Profile, Federal Automotive Statistical Tool, SAM.GOV

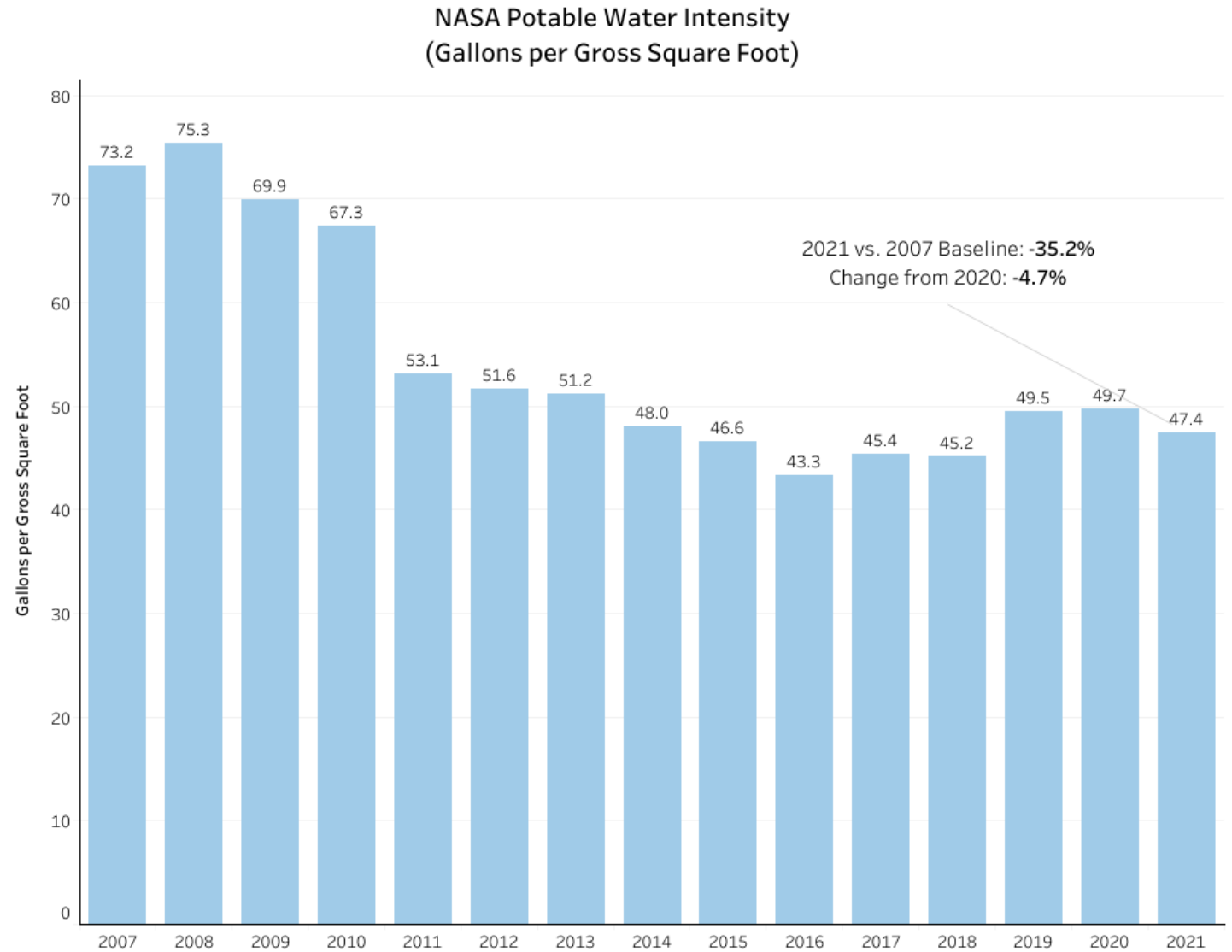
Office of
Management
and Budget
(OMB)
Scorecard



Building Energy Intensity

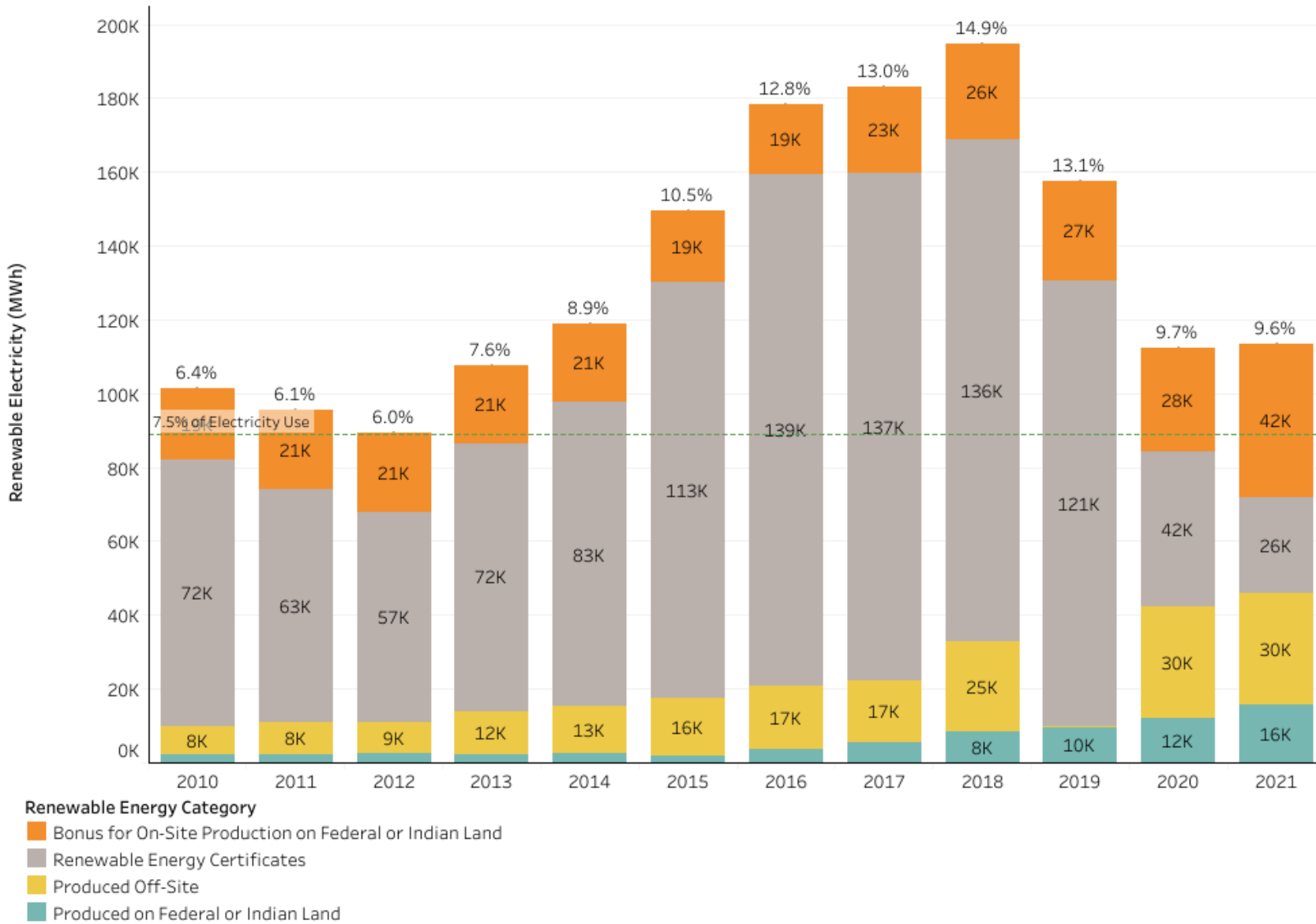


Potable Water Intensity

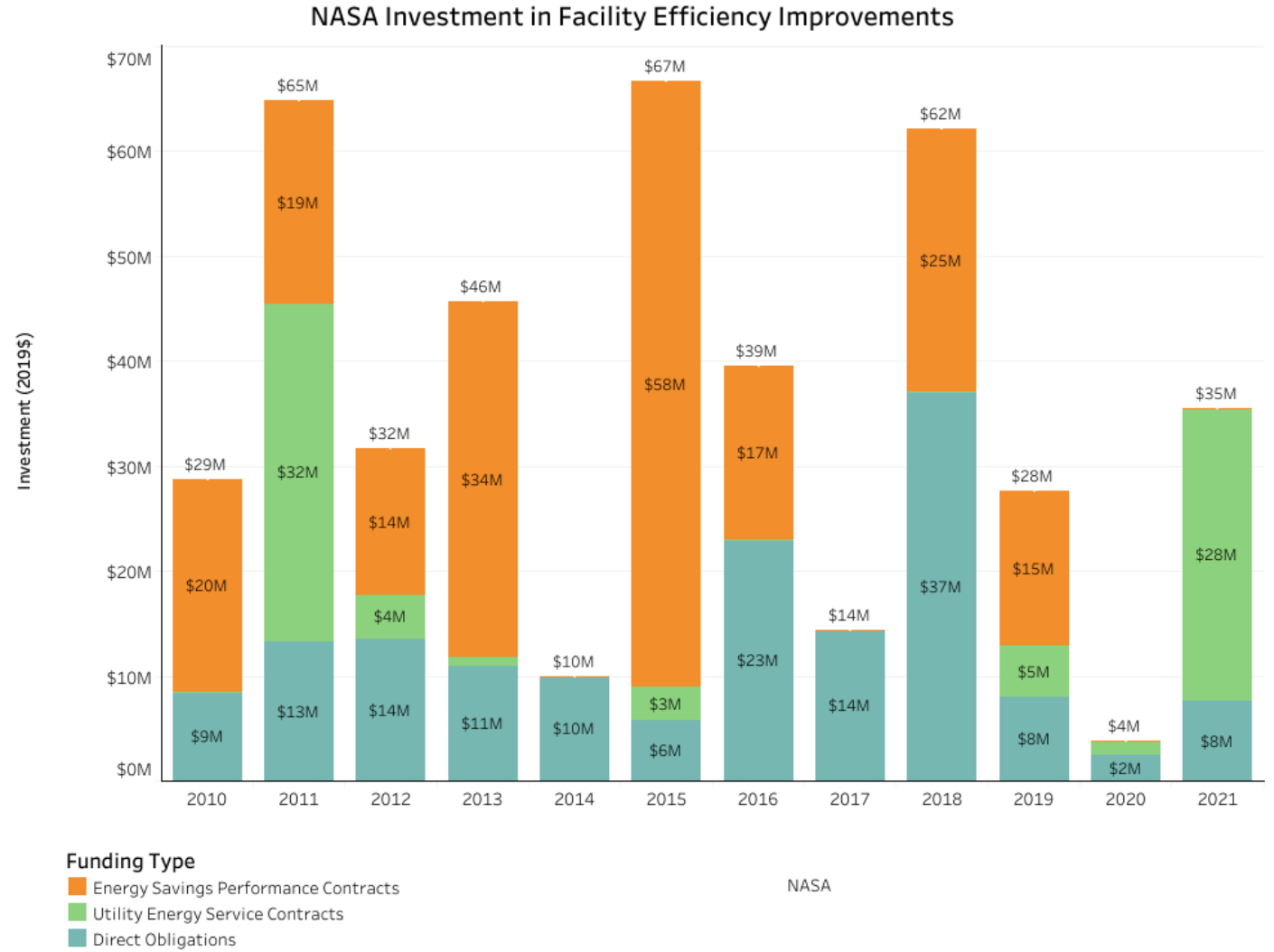


NASA Renewable Electricity Use
(as a Percentage of Facility Electricity Consumption)

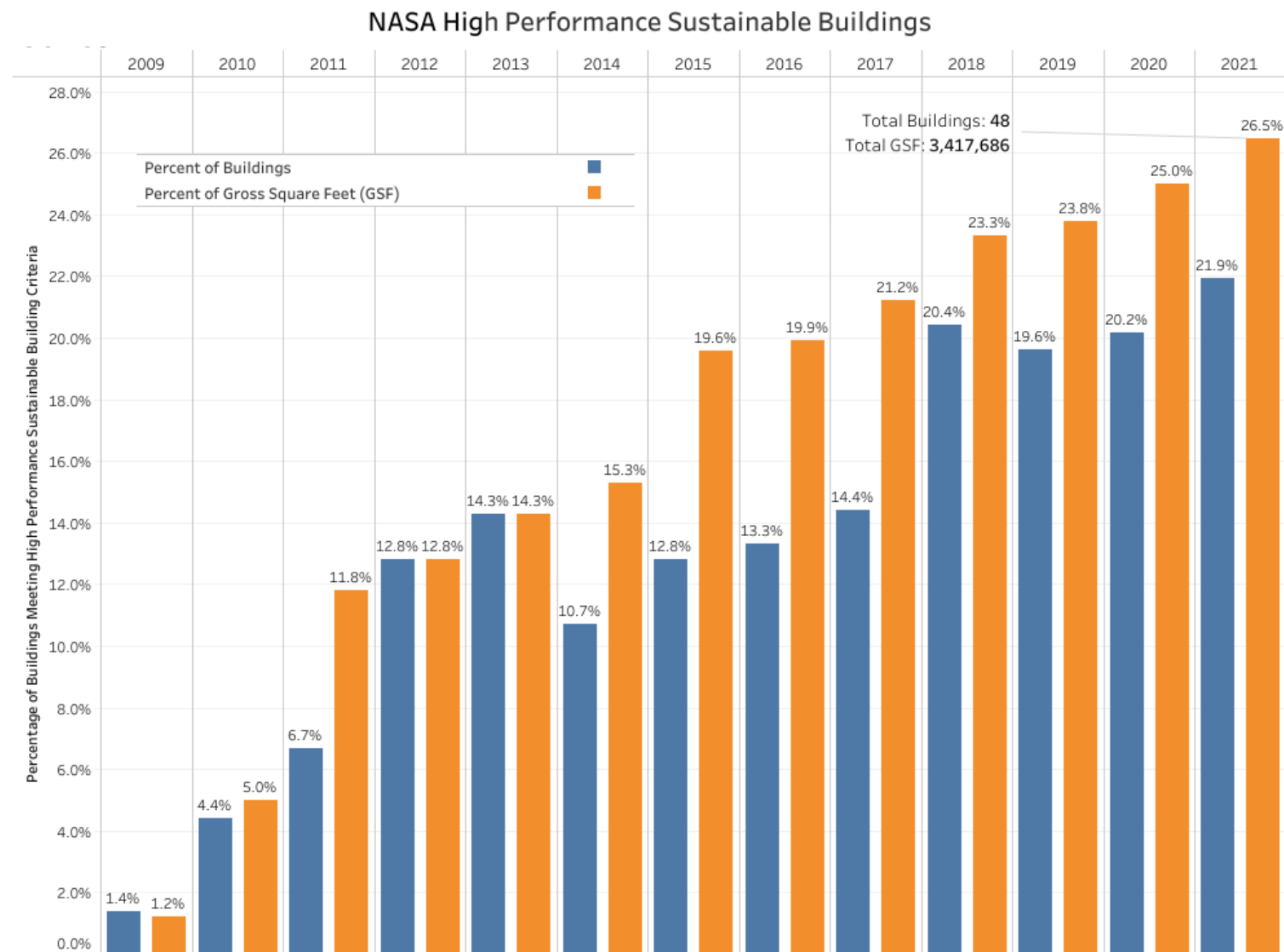
Renewable Electricity Use



Investment in Facility Efficiency Improvements



High Performance Sustainable Buildings



Note: From FY 2015 onward, only *eligible owned facilities* are being tracked for compliance with high performance sustainable building requirements



Thank you!